10:50:24 OCA PAD AMENDMENT - PROJECT HEADER INFORMATION 04/29/91

Active

Project #: E-20-633 Cost share #: E-20-355 Rev #: 1
Center # : R6666-0A0 Center shr #: F6666-0A0 OCA file #:
Work type : RES
Contract#: ENG-8852831 Mod #: 1 Document : GRANT
Prime #: Contract entity: GTRC

Subprojects ? : N
Main project #:

Project unit: CIVIL ENGR Unit code: 02.010.116
Project director(s):
MARTIN C S CIVIL ENGR (404)894-2224

Sponsor/division names: NATL SCIENCE FOUNDATION / GENERAL
Sponsor/division codes: 107 / 000

Award period: 881115 to 911030 (performance) 920130 (reports)

Sponsor amount	New this change	Total to date
Contract value	0.00	42,001.00
Funded	0.00	42,001.00
Cost sharing amount		46,155.00

Does subcontracting plan apply ?: N

Title: INTERFACING OF COMPUTERS WITH FLUID MECHANICS EXPERIMENTATION

PROJECT ADMINISTRATION DATA

OCA contact: Mildred S. Heyser 894-4820

Sponsor technical contact

ELIAS SCHUTZMAN
(202)357-5102

NATIONAL SCIENCE FOUNDATION
ENG-MSM
WASHINGTON, D.C. 20550

Sponsor issuing office

DONNA C. JENNINGS
(202)357-9602

NATIONAL SCIENCE FOUNDATION
DGC-ENG
WASHINGTON, D.C. 20550

Security class (U,C,S,TS) : U ONR resident rep. is ACO (Y/N): N
Defense priority rating : N/A NSF supplemental sheet
Equipment title vests with: Sponsor GIT X

Administrative comments -
SIX MONTHS' NO-COST EXTENSION TO OCTOBER 30, 1991 VIA OPAS WITH FINAL REPORT DUE JANUARY 30, 1992.

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

NOTICE OF PROJECT CLOSEOUT

2- NV SR342

Closeout Notice Date 08/26/92

Project No. E-20-633 Center No. R6666-0A0

Project Director MARTIN C S School/Lab CIVIL ENGR

Sponsor NATL SCIENCE FOUNDATION/GENERAL

Contract/Grant No. ENG-8852831 Contract Entity GTRC

Prime Contract No. _____

Title INTERFACING OF COMPUTERS WITH FLUID MECHANICS EXPERIMENTATION

Effective Completion Date 911030 (Performance) 920130 (Reports)

Closeout Actions Required:	Y/N	Date Submitted
Final Invoice or Copy of Final Invoice	N	
Final Report of Inventions and/or Subcontracts	N	
Government Property Inventory & Related Certificate	N	
Classified Material Certificate	N	
Release and Assignment	N	
Other _____	N	

CommentsBILLING VIA LINE OF CREDIT; 98A SATISFIES "PATENT" REPROTING REQUIREMENT.

Subproject Under Main Project No. _____

Continues Project No. _____

Distribution Required:

Project Director	Y
Administrative Network Representative	Y
GTRI Accounting/Grants and Contracts	Y
Procurement/Supply Services	Y
Research Property Managment	Y
Research Security Services	N
Reports Coordinator (OCA)	Y
GTRC	Y
Project File	Y
Other _____	N
_____	N

PROGRESS REPORT

NATIONAL SCIENCE FOUNDATION

INTERFACING OF COMPUTERS WITH FLUID MECHANICS EXPERIMENTATION

SCHOOL OF CIVIL ENGINEERING

GEORGIA INSTITUTE OF TECHNOLOGY

PROFESSOR C. SAMUEL MARTIN, PRINCIPAL INVESTIGATOR

DECEMBER 1988 - SEPTEMBER 1990

Introduction

The enhancement of instruction in the Fluid Mechanics Laboratory of the School of Civil Engineering began during Spring and Summer of 1989 once funds were available and equipment and software could be purchased. The initial acquisitions were two Hewlett-Packard PC Vectras and accompanying software and a MetraByte data acquisition card. For the initial 15 months of the project following acquisition of the equipment programs have been developed to use the system for acquisition of data in the wind tunnel. To date the principal uses of the computers in the fluid mechanics laboratory have been (1) calibration of transducers and flow meters and (2) determination of pressure distribution around square and circular cylinders in the wind tunnel. These experiments have been conducted by writing programs in QuickBasic to drive a MetraByte data acquisition card. The students take the data from the QuickBasic program and import it into spreadsheet programs such as LOTUS 123 or Quattro Pro for analysis and plotting.

Although only the MetraByte card and QuickBasic have been used to date in the laboratory, LabWindows and data acquisition using a Keithley 500 System are now being employed. Indeed, other experiments are now being designed to implement computer utilization. Brief descriptions are as follows.

Oil Flow Experiment

An oil flow facility for demonstrating laminar flow, transition to turbulence, and turbulent flow will be adapted for collecting pressure drop and flow data. The computer will collect flow data from a turbine meter along with pressure drop from a pressure transducer for a screen plot of head loss versus flow for the various flow regimes. The demonstration of Poiseuille flow law will be determined directly via the computer.

Wind Tunnel Experiments

The current experiments for determining pressure distribution and form drag on an airfoil, and square and circular cylinders will be enhanced by the acquisition of a scanning valve for the 40 pressure taps and stepping motors for positioning of Pitot tubes. Complete computer control will allow for the determination of pressure drag on the circular cylinder in the critical range, the effect of angle of attack of the airfoil and incidence angle of approach flow to the square cylinder. Moreover, a traverse of the Pitot tube in the wake of the respective body will allow for the determination of drag.

Further Experiments

Other computer-related experiments are currently being designed in conjunction with hardware to be purchased. One experiment will be the determination of the characteristics of a centrifugal pump. Another will be the measurement of frictional pressure drop in developed turbulent flow in a tube and the determination of head-loss characteristics of a ball valve utilizing an electronic flow meter and a scanning valve. The computer will also be used for experiments in (1) an oscillating flow in a U-Tube, (2) gravity wave characteristics, (3) waterhammer characteristics, and (4) cavitation in a venturi.

In summary, the project is well under way in terms of acquisition of hardware and software and implementation. There must be an accelerated pace of design and implementation during the next 6 months to complete the project. Appended is a list of equipment and other items acquired through September 1990.

ACQUISITIONS FOR NSF PROJECT

INTERFACING OF COMPUTERS WITH FLUID MECHANICS EXPERIMENTATION

Item	Use	Quantity
Hewlett-Packard Vectra QS16	Computer	2
Hewlett-Packard Vectra ES12	Computer	3
Keithley 500 System	Data Acquisition System	1
MetraByte DAS8 PGA	Data Acquisition Card	2
National Instruments HPIB	IEEE Control Card	1
Hewlett-Packard HPIB	IEEE Control Card	3
National Instruments MIO-AT	Data Acquisition Card	1
Hewlett-Packard HP Viper Card	HP BASIC Controller	2
National Instruments LabWindows	Data Acquisition Software	1
Hewlett-Packard Counter	Frequency Counter	1
Hewlett-Packard Digital Oscilloscope	Wave Forms, etc.	1
Hewlett-Packard Laser Jet IIP	Printer	2
Hewlett-Packard Thinkjet	Printer	2
Hewlett-Packard Paintjet	Printer	1
Hewlett-Packard Plotter	Plotter	2
Hewlett-Packard Digitizer	Curve Digitizing	1
Hewlett-Packard Signal Analyzer	Spectral Analysis	1
Tektronix Multimeter	IEEE Control	1
Flow Science Turbine Meter	Flow Meter	1
Clark Y-10 Airfoil	Pressure Distribution	1
Aneroid Barometer	Barometric Pressure	1
Software		
Miscellaneous Gages, etc.		

E20-633

OMB Number 345-0058

NATIONAL SCIENCE FOUNDATION
1800 G STREET, NW
WASHINGTON, DC 20550

BULK RATE
POSTAGE & FEES PAID
National Science Foundation
Permit No. G-69

PI/PD Name and Address

Charles S. Martin
Sch of Civil Engineering
Georgia Tech Research Corp
Atlanta GA 30332

NATIONAL SCIENCE FOUNDATION
FINAL PROJECT REPORT

PART I - PROJECT IDENTIFICATION INFORMATION

1. Program Official/Org. Frank D. Draper - EID

2. Program Name DIVISION OF ENGIN INFRASTRUCTURE DEVELOP

3. Award Dates (MM/YY) From: 11/88 To: 04/91

4. Institution and Address
Georgia Tech Research Corp
Administration Building
Atlanta GA 30332

5. Award Number 8852831

6. Project Title
Interfacing of Computers with Fluid Mechanics Experimentation

This Packet Contains
NSF Form 98A
And 1 Return Envelope

PART II - SUMMARY OF COMPLETED PROJECT

Award number: 8852831

Principal Investigator: C. Samuel Martin

Selected undergraduate experiments in hydraulics and fluid mechanics have been adapted to computer-based instrumentation and control for the enhancement of the teaching undergraduates. Moreover, the laboratory use of computers as data-acquisition tools has allowed for the introduction of new concepts in the teaching of laboratory fluid mechanics courses. Since many of the common fluid mechanics experiments are typically limited by laborious manual data acquisition, new insights are gained, as the few cases which can be covered in the time available and the delay in data analysis, which usually occurs well after the experiment is completed and the phenomena forgotten. This project demonstrated a twofold objective: (1) the introduction of students to modern methods of scientific data acquisition and control, and (2) the enhancement of teaching of fluid mechanical phenomena. The latter was the primary objective as it is well known that direct involvement and observation of fluid flows is essential for gaining a feel for the subject. The project accomplished this objective by allowing many more cases to be explored and by providing rapid feedback of the consequences of changing experimental variables.

One example of a computer-related experiment is the determination of the pressure distribution and form drag on an airfoil, square and circular cylinders by means of computer controlled A/D data acquisition cards connected to a pressure transducer and analog amplifier. By means of a scanning valve for the 40 pressure taps and stepping motors for positioning of Pitot tubes, such experiments as drag comparison by integration of pressure distribution with that of momentum balance using velocity traverses are accomplished. Another experiment is the determination of the characteristics of a centrifugal pump by mens of a PC-based data-acquisition system. Yet another is the measurement of frictional pressure drop in developed turbulent flow in a tube and the determination of head-loss characteristics of a ball valve utilizing an electronic flow meter and a scanning valve. The computer is also used for experiments in (1) an oscillating flow in a U-Tube, (2) gravity wave characteristics, (3) waterhammer characteristics, and (4) cavitation in a venturi.

The project also allowed for the introduction of commercially available data-acquisition software such as LABWINDOWS, HP BASIC PLUS, and INSTRUMENT BASIC for MS WINDOWS, to name a few.

PART IV — FINAL PROJECT REPORT — SUMMARY DATA ON PROJECT PERSONNEL

(To be submitted to cognizant Program Officer upon completion of project)

The data requested below are important for the development of a statistical profile on the personnel supported by Federal grants. The information on this part is solicited in response to Public Law 99-383 and 42 USC 1885C. All information provided will be treated as confidential and will be safeguarded in accordance with the provisions of the Privacy Act of 1974. You should submit a single copy of this part with each final project report. However, submission of the requested information is not mandatory and is not a precondition of future award(s). Check the "Decline to Provide Information" box below if you do not wish to provide the information.

Please enter the numbers of individuals supported under this grant.
Do not enter information for individuals working less than 40 hours in any calendar year.

	Senior Staff		Post-Doctorals		Graduate Students		Under-Graduates		Other Participants[1]	
	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.	Male	Fem.
A. Total, U.S. Citizens										
B. Total, Permanent Residents										
U.S. Citizens or Permanent Residents[2]:										
American Indian or Alaskan Native										
Asian										
Black, Not of Hispanic Origin										
Hispanic										
Pacific Islander										
White, Not of Hispanic Origin										
C. Total, Other Non-U.S. Citizens										
Specify Country 1.										
2.										
3.										
D. Total, All participants * (A + B + C)	0	0	0	0	0	0	0	0	0	0
Disabled[3]										

☐ Decline to Provide Information: Check box if you do not wish to provide this information (you are still required to return this page along with Parts I-III).

[1]Category includes, for example, college and precollege teachers, conference and workshop participants.

[2]Use the category that best describes the ethnic/racial status for all U.S. Citizens and Non-citizens with Permanent Residency. *(If more than one category applies, use the one category that most closely reflects the person's recognition in the community.)*

[3]A person having a physical or mental impairment that substantially limits one or more major life activities; who has a record of such impairment; or who is regarded as having such impairment. *(Disabled individuals also should be counted under the appropriate ethnic/racial group unless they are classified as "Other Non-U.S. Citizens.")*

AMERICAN INDIAN OR ALASKAN NATIVE: A person having origins in any of the original peoples of North America, and who maintain cultural identification through tribal affiliation or community recognition.

ASIAN: A person having origins in any of the original peoples of East Asia, Southeast Asia and the Indian subcontinent. This area includes, for example, China, India, Indonesia, Japan, Korea and Vietnam.

BLACK, NOT OF HISPANIC ORIGIN: A person having origins in any of the black racial groups of Africa.

HISPANIC: A person of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish culture or origin, regardless of race.

PACIFIC ISLANDER: A person having origins in any of the original peoples of Hawaii; the U.S. Pacific Territories of Guam, American Samoa, or the Northern Marianas; the U.S. Trust Territory of Palau; the islands of Micronesia or Melanesia; or the Philippines.

WHITE, NOT OF HISPANIC ORIGIN: A person having origins in any of the original peoples of Europe, North Africa, or the Middle East.

* Equipment Grant